IN THE CLAIMS:

Page 22, before Claim 1, delete:

~~CLAIMS~~

Page 22, before Claim 1, insert:

WHAT IS CLAIMED IS:

Please cancel claims 1-52 without prejudice or disclaimer, and substitute new claims 53-104 therefor as follows:

1-52 (Canceled)

53. (New) A fuel cell comprising:

(a) an anode;

(b) a cathode; and

(c) a polymer electrolyte membrane placed between the anode and the cathode which comprises at least one polyolefin grafted with side chains containing proton conductive functional groups;

wherein said fuel cell has:

a value of cell resistance at 90° not higher than 0.30 Ω cm^2; and

a value of cell resistance at 20°C differing from the value of cell resistance at 90° in an amount not higher than 90% with respect to the value of cell resistance at 90°.

54. (New) The fuel cell according to claim 53, wherein the value of cell resistance at 90°C is between 0.02 Ω cm^2 and 0.25 Ω cm^2.

55. (New) The fuel cell according to claim 54, wherein the value of cell resistance at 90°C is between 0.05 Ω cm^2 and 0.20 Ω cm^2.

56. (New) The fuel cell according to claim 53, wherein the value of cell resistance at 20°C differs from the value of cell resistance at 90°C in an amount not higher than 70% with respect to the value of cell resistance at 90°C.

57. (New) The fuel cell according to claim 56, wherein the value of cell resistance at 20°C differs from the value of cell resistance at 90°C in an amount not higher than 50% with respect to the value of cell resistance at 90°C.

58. (New) The fuel cell according to claim 53, wherein the side chains are grafted to the polyolefin through an oxygen bridge.

59. (New) The fuel cell according to claim 53, wherein the amount of grafting of the side chains is between 10% and 250%.

60. (New) The cell according to claim 59, wherein the amount of grafting of the side chains is between 40% and 230%.

61. (New) The fuel cell according to claim 53, wherein the fuel cell is a direct methanol fuel cell.

62. (New) The fuel cell according to claim 53, wherein the fuel cell is a hydrogen fuel cell.

63. (New) The fuel cell according to claim 53, wherein the polyolefin is selected from: polyethylene, polypropylene, polyvinylchloride, ethylene-propylene copolymers (EPR) or ethylene-propylene-diene terpolymers (EPDM), ethylene vinyl acetate copolymer (EVA), ethylene butylacrylate copolymer (EBA), polyvinylidenedichloride, polyvinylfluoride (PVF), polyvinylidenedifluoride (PVDF), vinylidene fluoride tetrafluoroethylene copolymer (PVDF-TFE), polyvinylidene-hexafluoropropylene copolymer, chlorotrifluoroethylene-ethylene copolymer, chlorotrifluoroethylene-propylene copolymer, polychloroethylene, ethylene-tetrafluoroethylene copolymer

(ETFE), propylene-tetrafluoroethylene copolymer, propylene-hexafluoropropylene copolymer, or ethylene-hexafluoropropylene copolymer.

64. (New) The fuel cell according to claim 63, wherein the polyolefin is polyethylene.

65. (New) The fuel cell according to claim 63, wherein the polyolefin is low density polyethylene (LDPE).

66. (New) The fuel cell according to claim 53, wherein the side chains are selected from any hydrocarbon polymer chain which contains proton conductive functional groups or which may be modified to provide proton conductive functional groups.

67. (New) The fuel cell according to claim 66, wherein the side chains are obtained by graft polymerization of unsaturated hydrocarbon monomers, said hydrocarbon monomers being optionally halogenated.

68. (New) The fuel cell according to claim 67, wherein the unsaturated hydrocarbon monomer is selected from: styrene, chloroalkylstyrene, α-methylstyrene, α,β-dimethylstyrene, α,β,β-trimethylstyrene, ortho-methylstyrene, p-methylstyrene, meta-methylstyrene, α-fluorostyrene, trifluorostyrene, p-chloromethylstyrene, acrylic acid, methacrylic acid, vinylalkyl sulfonic acid, divinylbenzene, triallylcyanurate, vinylpyridine, and copolymers thereof.

69. (New) The fuel cell according to claim 68, wherein the unsaturated hydrocarbons monomers are styrene or α-methylstyrene.

70. (New) The fuel cell according to claim 53, wherein the proton conductive functional groups are selected from sulfonic acid groups and phosphoric acid groups.

71. (New) The fuel cell according to claim 70, wherein the proton conductive functional groups are selected from sulfonic acid groups.

72. (New) A polymer electrolyte membrane comprising at least one polyolefin grafted with side chains containing proton conductive functional groups, said side chains being grafted to the polyolefin through an oxygen bridge.

73. (New) The polymer electrolyte membrane according to claim 72, wherein the amount of grafting (Δp (%)) of the side chains is between 10% and 250%.

74. (New) The polymer electrolyte membrane according to claim 73, wherein the amount of grafting (Δp (%)) of the side chains is between 40% and 230%.

75. (New) The polymer electrolyte membrane according to claim 72, wherein the polyolefin is selected from: polyethylene, polypropylene, polyvinylchloride, ethylene-propylene copolymers (EPR) or ethylene-propylene-diene terpolymers (EPDM), ethylene vinyl acetate copolymer (EVA), ethylene butylacrylate copolymer (EBA), polyvinylidenedichloride, polyvinylfluoride (PVF), polyvinylidenedifluoride (PVDF), vinylidene fluoride tetrafluoroethylene copolymer (PVDF-TFE), polyvinylidene-hexafluoropropylene copolymer, chlorotrifluoroethylene-ethylene copolymer, chlorotrifluoroethylene-propylene copolymer, polychloroethylene, ethylene-tetrafluoroethylene copolymer (ETFE), propylene-tetrafluoroethylene copolymer, propylene-hexafluoropropylene copolymer, or ethylene-hexafluoropropylene copolymer.

76. (New) The polymer electrolyte membrane according to claim 72, wherein the side chains are selected from any hydrocarbon polymer chain which contains proton conductive functional groups or which may be modified to provide proton conductive functional groups.

77. (New) A process for producing a polymer electrolyte membrane comprising the following steps:

(i) irradiating a polyolefin in the presence of oxygen to obtain an activated polyolefin at a radiation rate in the range of from 0.10 Gy/s to 100 Gy/s;

(ii) grafting the obtained activated polyolefin by reacting the same with at least an unsaturated hydrocarbon monomer for a time period in the range of from 20 minutes to 5 hours, said hydrocarbon monomer optionally containing at least the one proton conductive functional group, to obtain side chains grafted on the activated polyolefin; and

(iii) optionally providing said grafted side chains with proton conductive functional groups, if the latter are not contained in the unsaturated hydrocarbon monomer.

78. (New) The process according to claim 77, wherein the irradiation step (i) is carried out at a radiation rate of from 1.0 Gy/s to 10.0 Gy/s.

79. (New) The process according to claim 77, wherein the grafting step (ii) is carried out for a time period in the range of from 30 minutes to 4 hours.

80. (New) The process according to claim 77, wherein the irradiating step (i) is carried out by γ-rays, X-rays, UV light, plasma irradiation or β-particles.

81. (New) The process according to claim 80, wherein the irradiating step (i) is carried out by γ-rays.

82. (New) The process according to claim 77, wherein the total radiation dose in the irradiating step (i) is in the range of from 0.01 MGy to 0.20 MGy.

83. (New) The process according to claim 82, wherein the total radiation dose in the irradiating step (i) is in the range of from 0.02 MGy to 0.10 MGy.

84. (New) The process according to claim 77, wherein after the irradiating step (i), the activated polyolefin comprises organic hydroperoxy in an amount from 3 x 10^{-3} mol/kg to 70 x 10^{-3} mol/kg.

85. (New) The process according to the claim 84, wherein after the irradiating step (i), the activated polyolefin comprises organic hydroperoxy groups in an amount from 4 x 10^{-3} mol/kg to 50 x 10^{-3} mol/kg.

86. (New) The process according to claim 77, wherein the polyolefin is crosslinked or non-crosslinked before the irradiating step (i).

87. (New) The process according to claim 86, wherein the polyolefin is non-crosslinked.

88. (New) The process according to claim 77, wherein the grafting step (ii) is carried out at a temperature of 15°C to 150°C.

89. (New) The process according to claim 88, wherein the grafting step (ii) is carried out at a temperature of 45°C to 55°C.

90. (New) The process according to claim 77, wherein the grafting step (ii) is carried out in the presence of at least one hydroperoxy group decomposition catalyst.

91. (New) The process according to claim 90, wherein the hydroperoxy group decomposition catalyst is selected from: ferrous sulfate, ferrous ammonium sulfate, cobalt (II) chloride, chromium (III) chloride, or copper chloride.

92. (New) The process according to claim 91, wherein the hydroperoxy group decomposition catalyst is ferrous sulfate.

93. (New) The process according to claim 90, wherein the hydroperoxy group decomposition catalyst is added in an amount from 0.5 mg/ml to 10 mg/ml.

94. (New) The process according to claim 93, wherein the hydroperoxy group decomposition catalyst is added in an amount from 1.0 mg/ml to 6.0 mg/ml.

95. (New) The process according to claim 77, wherein, in the grafting step (ii), the hydrocarbon unsaturated monomers are dissolved in a solvent.

96. (New) The process according to claim 95, wherein the solvent is selected from ketones; alcohols; aromatic hydrocarbons; cyclic hydrocarbons; ethers; or esters.

97. (New) The process according to claim 77, wherein step (iii) is carried out by using a sulfonating or a phosphorating agent, in inert-gas atmosphere, or in air.

98. (New) The process according to claim 97, wherein the sulfonating agent is selected from chlorosulfonic acid, fluorosulfonic acid or sulfuric acid.

99. (New) The process according to claim 98, wherein the phosphorating agent is selected from chlorophosphoric acid or fluorophosphoric acid.

100. (New) The process according to claim 77, wherein step (iii) is carried out at a temperature of from 50°C to 150°C.

101. (New) The process according to claim 100, wherein step (iii) is carried out at a temperature of from 70°C to 100°C.

102. (New) An apparatus powered by the fuel cell of claim 53.

103. (New) The apparatus according to claim 102, wherein the apparatus is an engine for vehicle transportation.

104. (New) The apparatus according to claim 102, wherein the apparatus is an electronic portable device.